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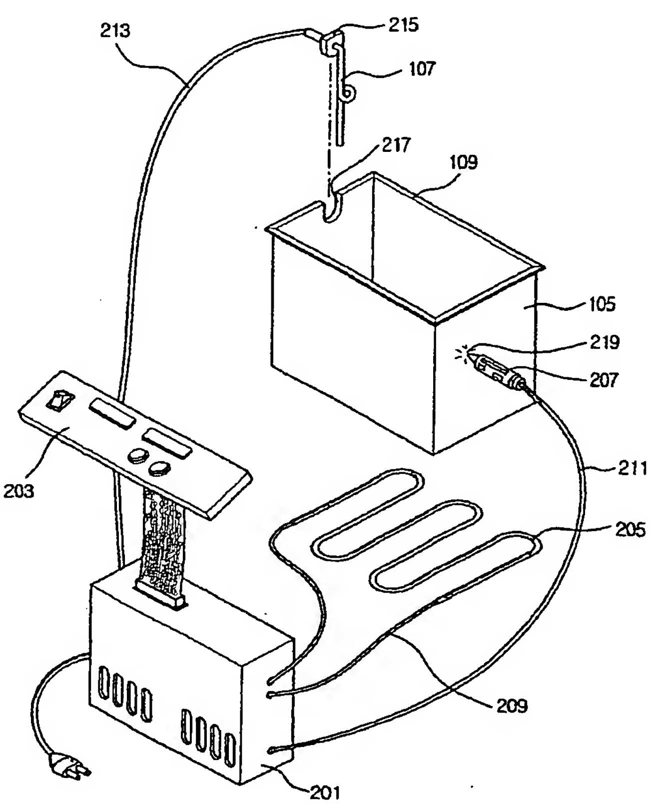
(54) Title: COOKER



(57) Abstract: The present invention includes a food receiving device for containing oil and foods, means for generating PWM signals, and ultrasound generator for generating ultrasound wave according to the PWM signal and providing the ultrasound wave to the food receiving device. The PWM generating means includes a controlling section, a pulse width modulating section, and a driving section. The controlling section generates a first digital signal and a second digital signal, respectively. The pulse width modulating section varies a duty of a saw-tooth signal by modulating saw-tooth signal and a pulse signal which are D/A converted from each of the first digital signal and the second digital signal, and outputs a duty-varied saw-tooth signal. The driving section amplifies the duty-varied saw-tooth signal and outputs an amplified signal as the PWM signal. The duty-varied saw-tooth signal is supplied to the food receiving device.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

COOKER

TECHNICAL FIELD

The present invention relates to a cooker using an ultrasound, and more particularly to a cooker having an ultrasound generator which is suitably installed at a receptacle for containing a fried food and oil.

BACKGROUND ART

In a conventional cooking method, when foods are fried or boiled in hot oil or water, surfaces of the foods are initially fried or boiled . And, foods the being cooked are gradually cooked from surface of the foods into the inside thereof. As a result, since the surfaces of the cooked foods in the hot oil are over-fried but the insides thereof are insufficiently fried, taste of the cooked foods has a reduction in quality.

For example, a frying system fries the fried foods in the oil of 100°C - 300°C. The frying system includes a container, a heater, and a main controller having a thermostatic controller. The thermostatic controller controls a temperature of the oil based on an output of a thermometer which is included therein. The main controller controls the heater according to the temperature of the oil detected by the thermostatic controller, thereby maintaining the oil and fried foods in the container.

The thermostatic controller detects a signal outputted from the thermometer, and the detecting signal is supplied to the main controller. The main controller compares the temperature of the oil with a reference temperature between 100°C and 300°C set by a user based on the detecting signal from the thermostatic controller and determines whether or not the oil is overheated according to the comparison result.

When the main controller determines that the oil is overheated, the main controller stops the heater to thereby prevent the overheating. When the main controller also determines

that the temperature of the oil is lower than the reference temperature, it turns on electric power of the heater to thereby increase the temperature of the oil.

However, in accordance with the conventional cooking method, a surface of the fried food is over-fried, and the inside thereof is under-fried, in hot oil which is kept at the reference temperature. Further, in order to improve the taste of the fried food, when a user adds spices to the frying food, the spices can not penetrated inside of the frying food. This causes the taste of the fried foods to lessen.

DISCLOSURE OF INVENTION

Therefore, one object of the present invention is to provide a food cooking device which can provide food with a good flavor and also reduce energy used when frying the food.

In order to achieve the object, an apparatus according to the present invention includes a receptacle; means for generating PWM signals; and an ultrasound generator for generating an ultrasound wave according to the PWM signal and providing the ultrasound wave to the receptacle, wherein an intensity of the ultrasound wave is varied by the PWM signal.

In order to achieve the object, an apparatus according to the present invention includes a controlling section for generating a first digital signal and a second digital signal, respectively; a pulse width modulating section for varying a duty of a saw-tooth signal by modulating a saw-tooth signal and a pulse signal which are D/A converted from each of the first digital signal and the second digital signal, and for outputting a duty-varied saw-tooth signal; and a driving section for amplifying the duty-varied saw-tooth signal and for outputting an amplified signal as the PWM signal.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, aspects and advantages will be better understood from the following detailed description of preferred embodiments of the invention with reference to preferred embodiments of the invention with reference to the drawings, in which;

FIG. 1 is a block diagram for showing a configuration of the cooker according to an embodiment of a present invention;

FIG. 2 is perspective view for showing the food receiving section shown in FIG. 1.;

FIG. 3 is a block diagram for showing one example of a PWM generator depicted in FIG. 1. ; and

FIG. 4 is a perspective view for showing a controller and an ultrasound generator which are welded at a surface of the receptacle depicted in FIG. 2.

BEST MODE FOR CARRYING OUT THE INVENTION

Preferred embodiments of the present invention will be illustrated below with reference to the accompanying drawings.

FIG.1 shows a block diagram for showing a configuration of the cooker according to an embodiment of a present invention. The cooker includes a food receiving section 30; means 10 for generating PWM signals; and an ultrasound generator 20 for generating an ultrasound wave according to the PWM signal and providing the ultrasound wave to the receptacle.

FIG. 2 is a perspective view for showing the food receiving section 10 shown in FIG. 1.

Referring to FIG. 2, the food receiving section 30 includes a housing 101, a control panel 103 having a power switch 113, a switch 117, a receptacle 105, a thermometer 107, a first display device 115, and a second display device 119.

The switch 117 sets heat time. The first display device 115, second display device 119, and receptacle 105 are installed at

an upper center of the housing 101, and the receptacle 105 contains liquid such as oil 111. The receptacle 105 includes a guide 109.

The receptacle 105 is filled with a liquid such as oil 111, and the oil 111 is gradually heated by heater. At this time, a user can set a temperature of the oil from 100°C to 300°C by the switch 117.

The switch 117 can consist of a push or rotary switch. The thermometer 107 is installed at an inner side wall of the receptacle 105. The thermometer 107 detects the temperature of the oil 111. A signal corresponding to the temperature of the oil 111 detected by the thermometer 107 is displayed on the first display device 115. Temperature information set by the user is displayed on the second display device 119 so that the user recognizes a heating state of the oil 111.

FIG. 3 is a block diagram for showing one example of a PWM generator 10 depicted in FIG. 1.

Referring to FIG. 3, the PWM generator 10 includes a control section 301, a pulse width modulating section 303, and a driver 307.

The control section 301 generates first and second digital signals for generating a saw-tooth and pulse signals, respectively.

The control section 301 includes a memory 311, a microcomputer 309, and an oscillator 313. The memory 311 stores first and second data. The microcomputer 309 generates the first and second digital signals corresponding to the first data and the second data, respectively, and varies a period of the generated second digital signal based on a system program.

The oscillator 313 generates a system clock to generate the first and second digital signals.

The pulse width modulating section 303 converts the first and second digital signals from the control section 301 into saw-tooth and pulse signals, modulating the saw-tooth according to the pulse signal in order to vary a duty of the saw-tooth signal

to thereby obtain a duty-varied saw-tooth signal. The pulse width modulating section 303 includes a first digital/analog(D/A) converter 315, a second D/A converter 317, a saw-tooth wave generator 319, and a duty modulator 312.

The first D/A converter 315 converts the first digital signal from the microcomputer 309 into an analog saw-tooth signal. The second D/A converter 317 regulates the second digital signal from the microcomputer 309 to a DC signal. The saw-tooth wave generator 319 wave-shapes the saw-tooth signal through the first D/A converter 315. The duty modulator 321 modulates the saw-tooth signal converted by the first D/A converter 315 on the DC signal.

The driver 307 amplifies the duty-varied saw-tooth signal from the pulse width modulating section 303 and supplies it to the ultrasound generator 207.

The buffer 305 is connected between the pulse width modulating section 303 and driver 307, and wave-shapes the varied saw-tooth signal from the pulse width modulating section 307 and provides it into the driver.

Also, the system program on the memory 311 has a first step for programming a 100% duty of the pulse data for a time, a second step for reducing the duty from 85-50% to 2.5-0% for a predetermined time, and third step for repeating the first and the second steps.

When a switch signal generated by the power switch 113 is inputted to the microcomputer 309, the microcomputer 309 enables the memory 311 to thereby drive the system program in response to the switch signal from the power switch 113.

Accordingly, the microcomputer 309 reads the first data and the second data stored in the memory 311, and converts the first data and the second data into the first and second digital signals, and supplies the first and second digital signals to the first converter 315 and the second converter 317, respectively.

The first D/A converter 315 converts the first digital signal to a saw-tooth signal of an analog type, and the second D/A

converter 317 converts the second digital signal into a pulse signal of an analog type. The pulse signal of an analog type is a variable DC signal based on a pulse width thereof. Namely, the DC signal is regulated by the second D/A converter 317.

Also, the first and second digital signals from the first and second converters 315 and 317 are supplied to the saw-tooth wave generator 319 and the duty modulator 321, respectively.

The saw-tooth wave generator 319 wave-shapes the saw-tooth signal converted by the first D/A converter 315, and the wave shaped saw-tooth signal is applied to the duty modulator 321.

At this time, the DC signal regulated by the second D/A converter 317 is provided to the duty modulator 321, and the duty modulator 321 modulates the saw-tooth signal according to the DC signal.

The level of the DC signal varies under the control of the microcomputer 309. As the microcomputer 309 controls a duty of the second digital signal by the first step, the second D/A converter 317 outputs a varied DC signal.

In the first step, a signal outputted from the second converter 317 is shaped to the DC signal, and the saw-tooth signal is modulated by the DC signal for 50 microseconds. Therefore, the duty modulator 321 generates and outputs a modulating signal of a DC type for 50 microseconds. During the first step, an ultrasound generator 207 is magnetically saturated by the DC modulating signal from the PWM generator 303.

In the second step, the microcomputer 309 controls a duty of the pulse signal to thereby vary a level of the DC signal for a predetermined time. The duty modulator 321 generates a modulating signal which gradually reduces the duty of the saw-tooth signal for a predetermined time.

Namely, since the level of the DC signal varies according to the varied duty of the pulse signal, the duty of the pulse signal is regulated by the second converter 317. In this way, the microcomputer 309 controls the pulse width of the pulse signal

in such a way that the duty of the pulse signal is gradually reduced from 85-50% to 2.5-0% for a predetermined time period. At this time, a frequency of the saw-tooth is varied in a bandwidth such that the frequency of the ultrasound is varied in the bandwidth. The bandwidth may be selected and varied according to a variety of cooking methods. Selectively, the frequency of the saw-tooth signal may maintain a constant value. Therefore, it is understood by one in the art that the frequency of the saw-tooth does not limit the scope of the present invention.

Thus, the ultrasound generator 207 provides an ultrasound wave responding to the pulse width modulating signal to the receptacle 105. In the third step, the microcomputer 309 continuously repeats the first and second steps. Namely, the modulating signal through the first step, the second step and the third step supplies the ultrasound wave to the oil 111 and fried foods.

FIG. 4 is a perspective view showing a controller 201 and the ultrasound generator 207 which is welded at a surface of the receptacle 105.

A heater 205 is installed at a bottom of the receptacle 105. A controller 201 is connected with the ultrasound generator 207 through a driving cord 211, connected with the heater 205 through a heating power cord 209 electrically, and connected with the thermometer 107 through a signal cord 213. Also, the controller 201 connected with a control PCB 203 which includes the switch 117, the power switch 113, the first display device 115 and the second display device 117.

The thermometer 107 is installed at the guide 109 of the receptacle 105 by a holder 215.

The ultrasound generator 207 includes a piezo electric element or a magnetostriction, in the present invention.

One end of the ultrasound generator 207 is welded to a side of the receptacle 105, and the other end thereof is connected to the controller 201 through the driving cord 211.

The ultrasound generator 207 supplies an ultrasound to the surface of the receptacle 105 to resonate the liquid such as the oil 111 in the receptacle 109.. When a user turns on the power switch 113 in the control panel 103, the controller 201 drives the heater 205 based on a switching signal of the power switch 113, to thereby boil the oil 111.

Thus, the thermometer 107 measures a temperature of the oil 111 and outputs the measured temperature of the oil 111 to the controller 210. The controller 201 receives the measured temperature of the oil 111 from the thermometer 107 and outputs an analog detecting signal corresponding thereto. A detecting signal from the thermometer 107 is transmitted to the control PCB 203, and the control PCB 203 converts the analog detecting signal from the controller 201 into a digital signal for an oil temperature.

The first display device 115 displays the digital signal of the oil temperature. At this time, the user sets a temperature of the oil by the switch 117. A switching signal of the switch 117 is transmitted to the controller 201. The controller 201 which receives the switching signal stores data according to the switching signal. The stored data are displayed on the second display device 117.

The controller 201 compares the stored data displayed on the second display device 117 with the digital signals displayed on the first display device 115. As a result of the comparison by the controller 201, when the stored data is equal to the digital signal, the controller 201 terminates the electric power which is supplied to the heater 205.

While the temperature of the oil increases, the controller 201 drives the magnetostriction gradually. Therefore, the welding section 219 of the magnetostriction emits the ultrasound to a surface of the receptacle 105, and the ultrasound is propagated to the oil 111 in the receptacle 105 to thereby allow the oil to resonate ultrasonically. At this time, the receptacle 105 is used

by means of resonator.

Therefore, the present invention provides the cooker which can reduce extra fat in the fried food, and improve flavor by ultrasound of the magnetostriction.

While the invention has been described in terms of one preferred embodiment, those skilled in the art will recognize that the invention can be practiced with modification within the spirit and scope of the appended claims.

WHAT IS CLAIMED IS:

1. A cooker comprising;

a food receiving device for containing foods;

means for generating PWM signals; and

an ultrasound generator for generating an ultrasound wave according to the PWM signal and providing the ultrasound wave to the food receiving device, wherein an intensity of the ultrasound wave is varied by the PWM signal.

2. The cooker as claimed in claim 1, wherein the ultrasound wave includes a bandwidth of 15KHz - 160KHz.

3. The cooker as claimed in claim 1, wherein the generating means includes a controlling section for generating a first digital signal and a second digital signal, respectively;

a pulse width modulating section for varying a duty of the saw-tooth signal by modulating a saw-tooth signal and a pulse signal which are D/A converted from each of the first digital signal and the second digital signal, and for outputting a duty-varied saw-tooth signal; and

a driving section for amplifying the duty-varied saw-tooth signal and for outputting an amplified signal as the PWM signal.

4. The generating means as claimed in claim 3, wherein the controlling section includes a memory for storing first data and second data; and

a microcomputer for generating a first digital signal and a second digital signal corresponding to each of the first data and the second data.

5. The generating means as claimed in claim 3, wherein the pulse width modulating section includes a first converter for converting the first digital signal by the microcomputer to an analog type saw-tooth signal;

a second converter for regulating the second digital signal by the microcomputer to a DC signal; and

a duty-modulator for modulating the analog type saw-tooth signal and the DC signal, and for outputting the duty-varied

saw-tooth signal.

6. The cooker as claimed in claim 1, wherein the ultrasound generator includes a piezo electric element.

7. The cooker as claimed in claim 1, wherein the ultrasound generator includes a magnetostriction element.

8. The generating means as claimed in claim 3, wherein the saw-tooth signal wave maintains the 100% duty for 50 micro second, and reduces the duty to 2.5-0% from 85-50% in a fixed time period.

FIG. 1

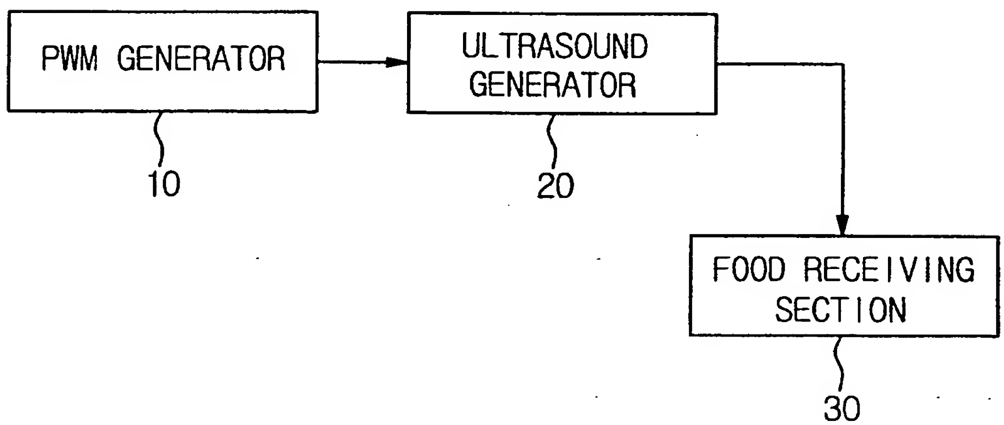

PWM GENERATOR
10
ULTRASOUND GENERATOR
20
FOOD RECEIVING SECTION
30

FIG.2

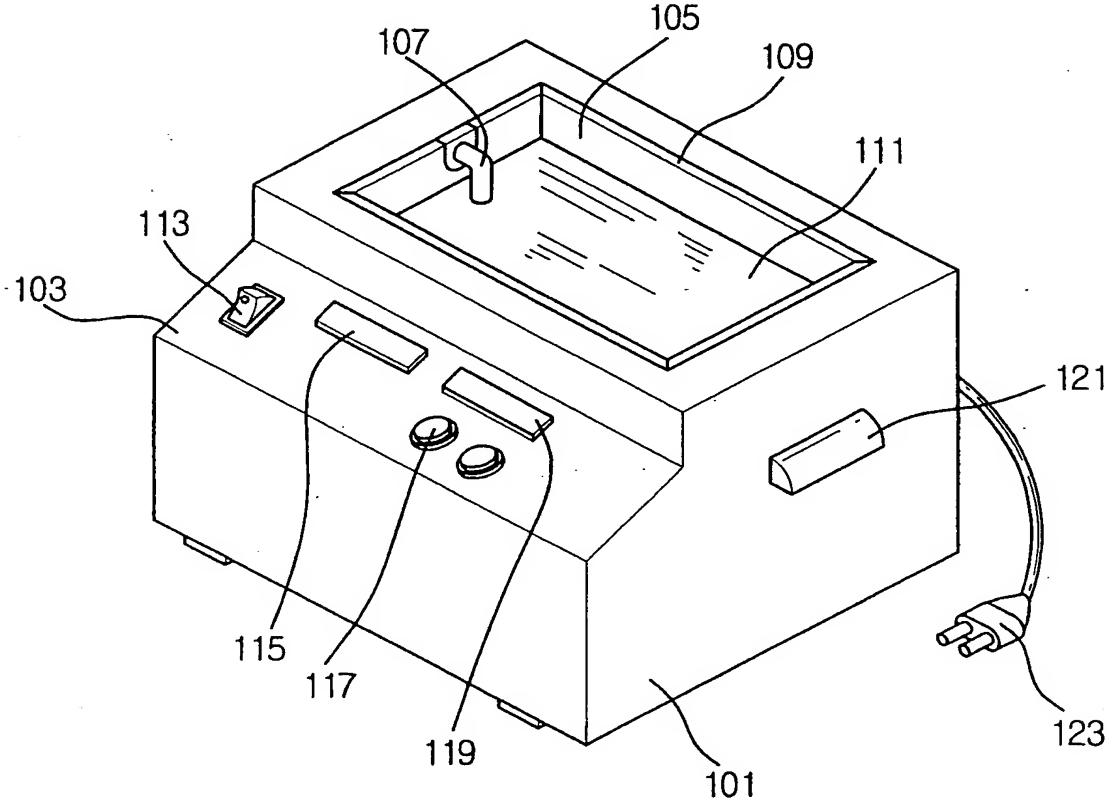
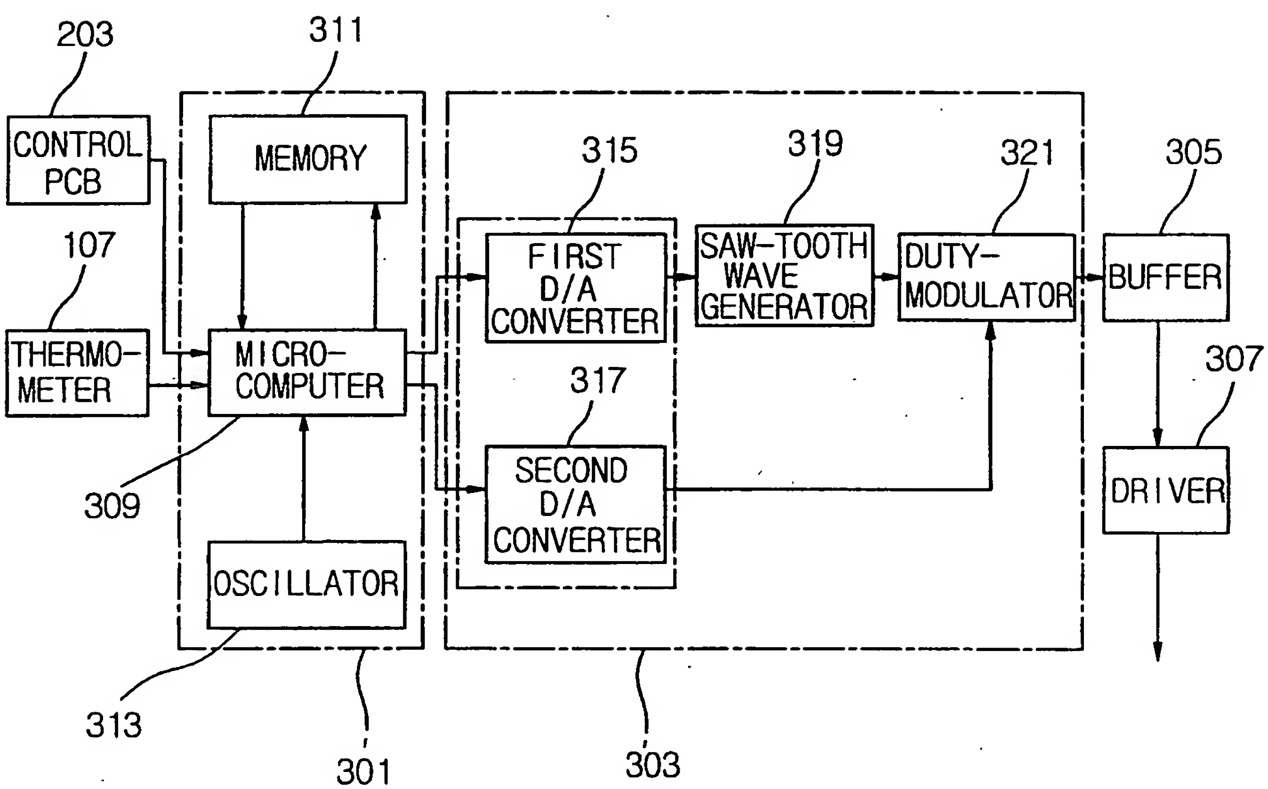
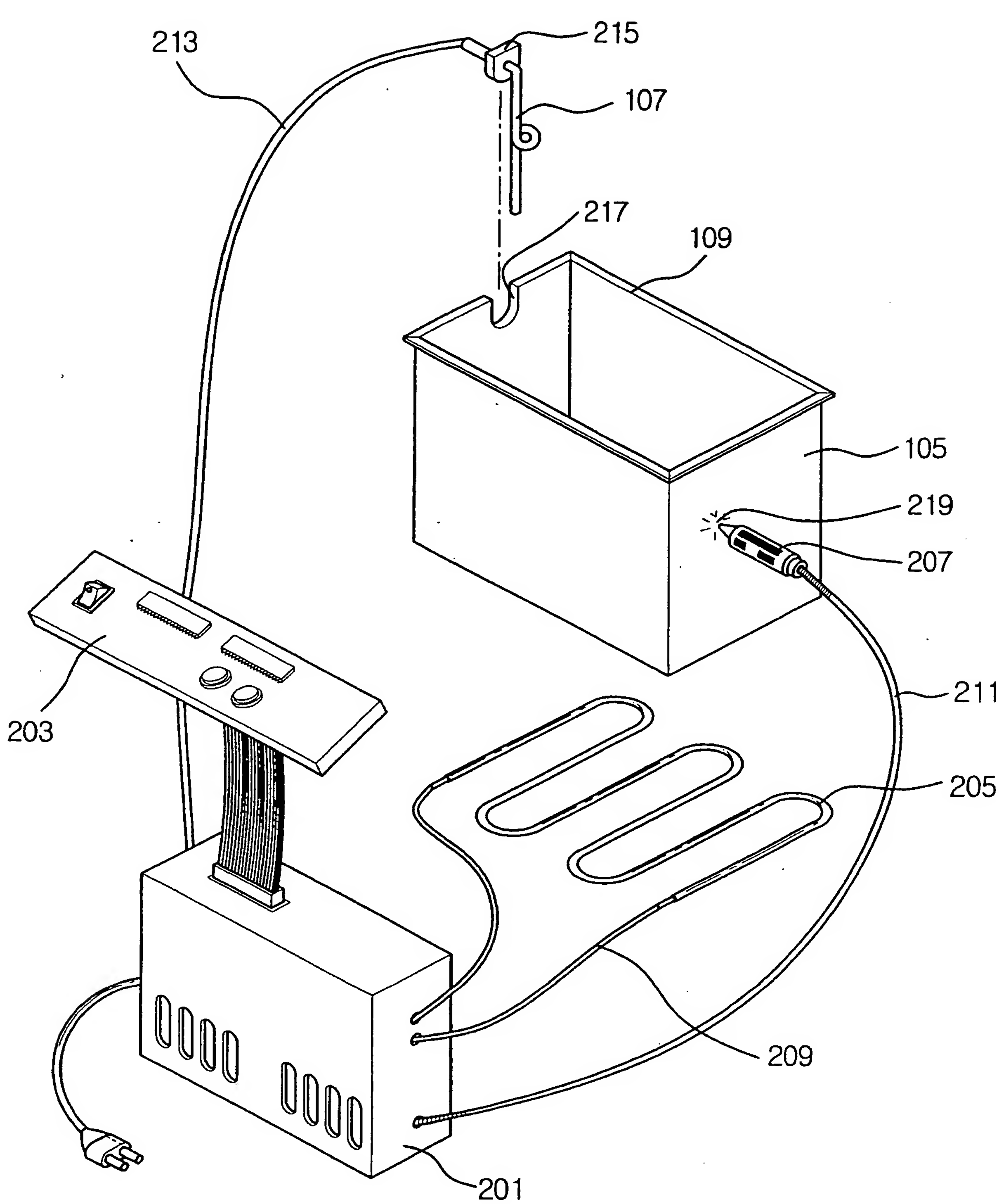


FIG.3



203
311
CONTROL PCB
MEMORY
315
319
321
305
107
FIRST D/A CONVERTER
SAW-TOOTH WAVE GENERATOR
DUTY-MODULATOR
BUFFER
THERMO-METER
MICRO-COMPUTER
317
307
309
SECOND D/A CONVERTER
DRIVER
OSCILLATOR
313
301
303

FIG.4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR00/00149

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 A47J 37/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimun documentation searched (classification system followed by classification symbols)

IPC7 A47J 37/12, A47J 37/00, A47J 37/06, A47J 36/38, F24C 7/00, F24C 7/02, F24C 15/20

Documentation searched other than minimun documentation to the extent that such documents are included in the fileds searched

Korean Patents and application for inventions since 1975
Korean Utility models and application for Utility models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search trerms used)
NPS, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	JP 6-272869 A(TOSHIBA CORPORATION) 27 September 1994 see the whole document	1-8
Y	KR 1994-146851 A(TOSHIBA CORPORATION) 18 November 1994 see the whole document	1-7
A	JP 63-223417 A(TOSHIBA CORPORATION) 16 September 1988 see the abstract & figure	1-3, 6-7
A	JP 63-259327 A(SANYO ELECTRIC CORPORATION) 26 October 1988 see the whole document	1-2, 6-7
A	JP 2-115620 A(SANYO ELECTRIC CORPORATION) 27 April 1990 see the abstract & figure	1-2, 6-7
A	JP 1-232689 A(SANYO ELECTRIC CORPORATION) 18 September 1989 see the abstract & figure	1-2, 6-7

[ ] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
23 MAY 2000 (23.05.2000)	24 MAY 2000 (24.05.2000)

Name and mailing address of the ISA/KR	Authorized officer
Korean Industrial Property Office Government Complex-Taejon, Dunsan-dong, So-ku, Taejon Metropolitan City 302-701, Republic of Korea	KWON, Oh Hee
Facsimile No. 82-42-472-7140	Telephone No. 82-42-481-5629

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR00/00149

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